Week 3: Practice Quiz

Topics: recurrences and mergesort

Collaboration level 0 (no restrictions). Open notes. Max time: unlimited

1. Consider the following recurrence $T(n) = 2T(n-2) + 1$, with $T(1) = T(2) = \Theta(1)$. The solution for this recurrence is

   A. $\Theta(n)$

   B. $\Theta(2^n)$

   C. $\Theta(2^{n/2})$

2. Consider the following recurrence $T(n) = T(n/2)+n$, with $T(1) = T(2) = \Theta(1)$. The solution for this recurrence is

   A. $\Theta(\lg n)$

   B. $\Theta(n)$

   C. $\Theta(n \lg n)$

3. Consider the following recurrence $T(n) = T(n-3) + \Theta(n)$, with $T(1) = \Theta(1)$. The solution for this recurrence is

   A. $\Theta(n)$

   B. $\Theta(n^2)$

   C. $\Theta(n \lg n)$

   D. $\Theta(2^n)$

4. Consider the following recurrence $T(n) = T(4n/5) + 1$, with $T(1) = T(2) = T(3) = T(4) = \Theta(1)$. The solution for this recurrence is

   A. $\Theta(\lg n)$

   B. $\Theta(n)$

   C. $\Theta(n \lg n)$

5. Select the recurrence that best describes the worst-case running time of Binary Search:

   A. $T(n) = T(n/2) + \Theta(1)$

   B. $T(n) = 2T(n/2) + \Theta(1)$

   C. $T(n) = T(n/2) + \Theta(n)$

6. Assume we modified Binary Search to check elements at indices $i = n/3$ and $j = 2n/3$ in the array, and recurse either on $A[0..i]$ ort $A[i+1, j]$ or $A[j+1, .., n-1]$. Which recurrence describes the worst-case running time of this algorithm:

   A. $T(n) = T(n/2) + \Theta(1)$

   B. $T(n) = T(n/2) + \Theta(n)$

   C. $T(n) = T(n/3) + \Theta(1)$

7. Consider the following recursive version of a linear search algorithm, which searches the array A starting at index i looking for target t.

   LSearch (array A, int i, element t):
   //return True if any element in A[i], ..., A[n-1] equals t; False otherwise

   - if $i == size(A)$: return False
   - else :
     - if A[i] == t: return TRUE
     - else return LSearch(A, i+1, t)

   Which recurrence describes the worst-case running time of this algorithm when called on an array A of n elements, with $i = 0$?

   A. $T(n) = T(n/2) + \Theta(1)$

   B. $T(n) = T(n-1) + \Theta(n)$

   C. $T(n) = T(n-1) + \Theta(1)$

Answers:

1. C
2. B
3. B
4. A
5. A
6. C
7. C